

APPLICATION

FOR

UNITED STATES OF AMERICA

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SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

Be it known that we,

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Both Italian citizens

have invented certain improvements in:

**"REINFORCEMENT FOR PREFABRICATED CONCRETE PANELS  
WITH IMPROVED BONDING TO CONCRETE "**

of which the following description in connection with the accompanying drawings is a specification, like reference characters on the drawings indicating like parts in the several figures.

## BACKGROUND OF THE INVENTION

The present invention relates to a reinforcement for prefabricated concrete panels with improved bonding to concrete.

5 Prefabricated concrete panels having a metallic reinforcement composed of longitudinal profiles, optionally connected to each other by transverse profiles, are known.

In such panels, the bonding between the concrete body of the panel and the metal profiles that constitute the reinforcement is crucially important, since the overall mechanical strength of the panel depends on this bonding.

10 Bonding between a metal profile and concrete is difficult to achieve, due to the fact that the profile has smooth flat surfaces arranged in a single unchanging direction and therefore do not offer any possibility of grip to the concrete along such direction.

15 In order to solve this problem, reinforcements have been provided which are composed of profiles having perforations on their faces, for example as disclosed in EP 381,000 by the same Applicants, through which the concrete, during the manufacture of the panel, can pass, firmly anchoring the reinforcement in the panel body.

20 Over the years, this type of reinforcement has proved to be susceptible of improvements aimed at further increasing the bonding effect between the reinforcement and the concrete.

## SUMMARY OF THE INVENTION

25 The aim of the present invention is to provide a reinforcement for prefabricated concrete panels which achieves high bonding to the concrete body of the panel, thus allowing to obtain panels which have a greater mechanical strength and duration.

30 Within this aim, an object of the invention is to provide a reinforcement which effectively avoids decohesion even as a consequence of fatigue stresses, or if the reinforcement profiles are not perfectly clean when the

panel is formed.

Another object of the invention is to provide a reinforcement which ensures excellent cohesion of the panel even in the presence of variously orientated stresses.

5 Another object of the invention is to provide a reinforcement which achieves adequate bonding with the concrete regardless of its formulation, particle size, thickness, density etcetera.

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10 This aim and these and other objects which will become better apparent hereinafter are achieved by a reinforcement for prefabricated concrete panels, comprising profiles to be embedded in the concrete body of a panel, characterized in that at least some of said profiles have perforations and undulations which are suitable to increase the bonding between the reinforcement and the concrete body of the panel.

#### BRIEF DESCRIPTION OF THE DRAWINGS

15 Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment of the reinforcement according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

20 Figure 1 is a perspective view of a reinforcement according to the invention;

Figure 2 is an enlarged-scale perspective view of a detail of Figure 1;

Figure 3 is an enlarged-scale perspective view of another detail of Figure

1;

25 Figure 4 is a side elevation view of a profile of the reinforcement according to the invention;

Figure 5 is a transverse sectional view of the profile of Figure 4, taken along the line V-V;

30 Figure 6 is a top plan view of the profile of Figure 4;

Figure 7 is a side elevation view of the profile, illustrating a second embodiment of the undulations according to the present invention;

Figures 8 and 9 are top plan views of the profile, illustrating a third and a fourth embodiment of the undulations;

Figures 10 and 11 are enlarged-scale transverse sectional views of the profile, illustrating two possible shapes of the undulations.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

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With reference to the figures, the reinforcement according to the invention, generally designated by the reference numeral 1, comprises profiles 2-7 which are designed to be embedded into the concrete body of a panel.

Preferably, the reinforcement 1 comprises a frame-like structure composed of longitudinal profiles 2 and 3, which are connected one another by transverse profiles 4, 5, 6 and 7. Clearly, the number of longitudinal and transverse profiles can vary according to the requirements and to the dimensions of the panel to be provided.

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Such profiles can have a substantially C-shaped transverse cross-section with two end wings 11 and 12 which are substantially parallel to each other and are joined by an intermediate wing 13.

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Preferably, such profiles have a substantially Σ-shaped transverse cross-section (see Figure 5), with two end wings 11 and 12 which are substantially parallel to each other and are joined by an intermediate wing 13 having at least two portions 14 and 15 which are inclined with opposite inclinations.

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In the illustrated embodiment, the intermediate wing 13 has a central portion 16 and two end portions 17 and 18 being joined to the end wings 11 and 12. The portions 16, 17 and 18, except for a reinforcement fold provided in an intermediate region of the extension of the portions 17 and 18, lie on planes which are substantially perpendicular to the planes of arrangement of the end wings 11 and 12 and are connected one another by the two inclined portions 14 and 15.

According to the invention, some or all of the profiles 2, 3, 4, 5, 6 and 7 that compose the reinforcement 1 have perforations or undulations which

are suitable to increase bonding between the reinforcement and the body of the concrete of the panel.

More particularly, it is possible to provide preferably slotted perforations 21 which are possibly arranged along a plurality of rows on the two end wings 11 and 12 of the profiles.

It is also possible to provide perforations 22 in the end portions 17 and 18 of the intermediate wing 13.

Perforations 23a, alternated with groups of perforations 23b, can be provided also on the central portion 13 of the intermediate wing 16.

Some of the perforations 23a and 23b can be used to support accessories which are designed to be partly or fully embedded inside the concrete body of the panel and are used to lift or move the panel after its manufacture. Such accessories can be constituted by tubular bodies 25 if the lifting device is of the type disclosed in US-6,092,849 by the same Applicants, or by plates 26 if the lifting device is of the type disclosed in USSN. 08/055,116 also by the same Applicants.

In the case of a tubular body 25, such body is inserted, before casting the body of the concrete, in a hole 23a which is adequately shaped so as to correspond to the tubular body 25.

In the case of lifting plates 26, such plates can instead be inserted in the rectangular perforations 23b.

Perforations 23a and 23b are of course alternated along the longitudinal extension of the profiles 2-7 so as to allow to position the accessories 25 and 26 in the chosen region.

Together with the plate 26, the reinforcement can support optional boxes 27 with the corresponding cover 27a for delimiting regions which must not be affected by the concrete casting that constitutes the body of the panel.

~~The undulations, according to requirements, can affect coplanar portions or non-coplanar portions of the profiles. In particular, it is possible to provide undulations on the two end wings 11 and 12 in one or more regions~~

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and/or undulations on the portions 14, 15, 16, 17 and 18.

The undulations can be advantageously provided proximate to the free edges of the end wings 11 and 12 and/or can be provided between the perforations provided in these portions and in the other portions of the profiles.

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5 The undulations may also affect, as shown in particular in Figure 7 wherein the undulations have been designated by the reference numeral 30, the edges of the perforations 22 so as to arrange the edges of the perforations on different planes in order to affect larger concrete cross-sections at the perforations.

10 As shown in Figure 4, the undulations, designated by the reference numeral 31, can simply be arranged between the perforations 22 without affecting their edge.

15 Conveniently, as shown in particular in Figure 6, the undulations, designated by the reference numeral 32, can have parallel sides or, as shown in Figure 8, in which said undulations are designated by the reference numeral 33; can have sides which are inclined with respect to each other, or also, as shown in Figure 9, in which the undulations have been designated by the reference numerals 34, can have intersecting sides.

20 According to requirements, as shown in Figure 10, the undulations 32, 33, 34 can have a constant height or depth or, as shown in Figure 11, can have a height or depth which increases toward the edges of the profiles.

If the panel to be manufactured is very thick, the frame-like structure of the reinforcement according to the invention can have longitudinal and/or transverse sides which are constituted by two or more of the above described profiles, coupled by means of two end wings thereof, i.e., by two or more superimposed profiles, so as to achieve the intended thickness for the panel to be provided. In this manner it is possible to meet various thickness requirements for the panel with a reduced range of profile types.

25 30 The profiles 2-7 are preferably made of metal and the undulations are

constituted by plastic deformations of such profiles.

In practice it has been observed that the reinforcement according to the invention fully achieves the intended aim and objects, since the presence of the perforations, combined with the presence of the undulations, interrupts the continuity of the profiles and alters the planar profile of the faces of the profiles, thus achieving high bonding of the reinforcement to the concrete constituting the body of the panel.

In particular, the undulations, by affecting coplanar portions and variously inclined portions of the profiles, ensure high bonding between the reinforcement and the concrete regardless of the orientation of the stresses to which the panel is subjected. This achieves greater strength and longer life of the panel.

The reinforcement thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details may further be replaced with other technically equivalent elements.

In practice, the materials used, so long as they are compatible with the specific use, as well as the dimensions, may be any according to requirements and to the state of the art.

The disclosures in Italian Patent Application No. MI2000A000297 from which this application claims priority are incorporated herein by reference.